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CORNING GLASS WORKS
CORNING
RALEIGH, NORTH CAROLINA

ELECTRONIC PRODUCTS DIVISION

3900 ELECTRONICS DRIVE
ZIP 27604
TEL: 919 828-0511

January 5, 1967

[redacted] STAT

Dear Ed:

Enclosed are three samples of FOTOFORM brand glass heat treated to different degrees. The data was obtained by making measurements on small pieces cut off of each sample.

Figures 1 thru 3 show the relationship between light intensity and angle. The gain (k) is computed for each sample over a range of angles, and is listed in Table 5 and shown graphically in Figure 4. Figure 5 shows the fraction of incident power scattered into a $\pm 45^{0}$ angle ($T_{45}$) as a function of axial gain. Table 5 summarizes the results.

Very truly yours,

[redacted] STAT

Product Planning — Military

MRS:ngw

Enclosures (5)

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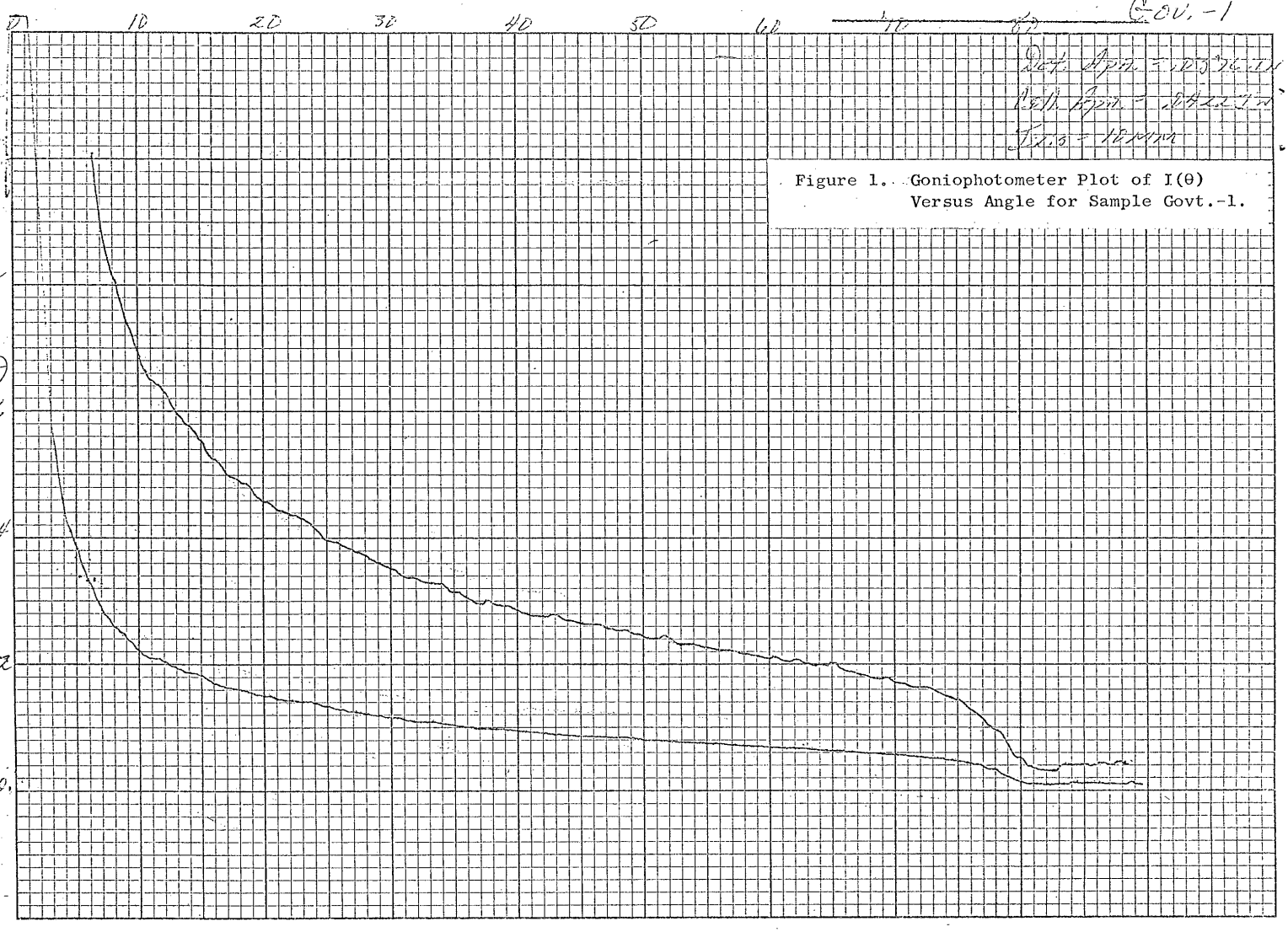


Figure 1. Goniophotometer Plot of I(θ) Versus Angle for Sample Govt.-1.



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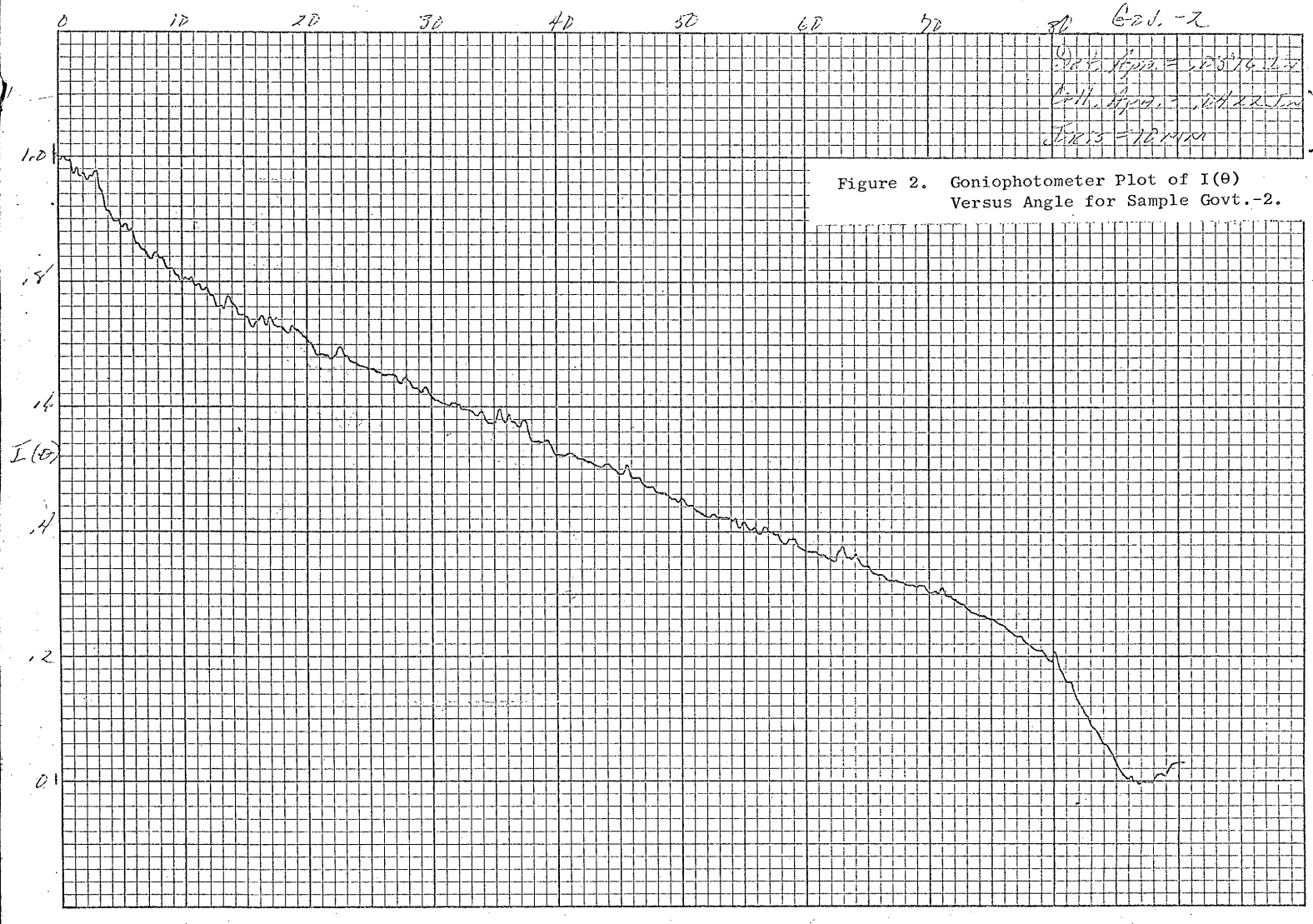


Figure 2. Goniophotometer Plot of I(θ) Versus Angle for Sample Govt.-2.



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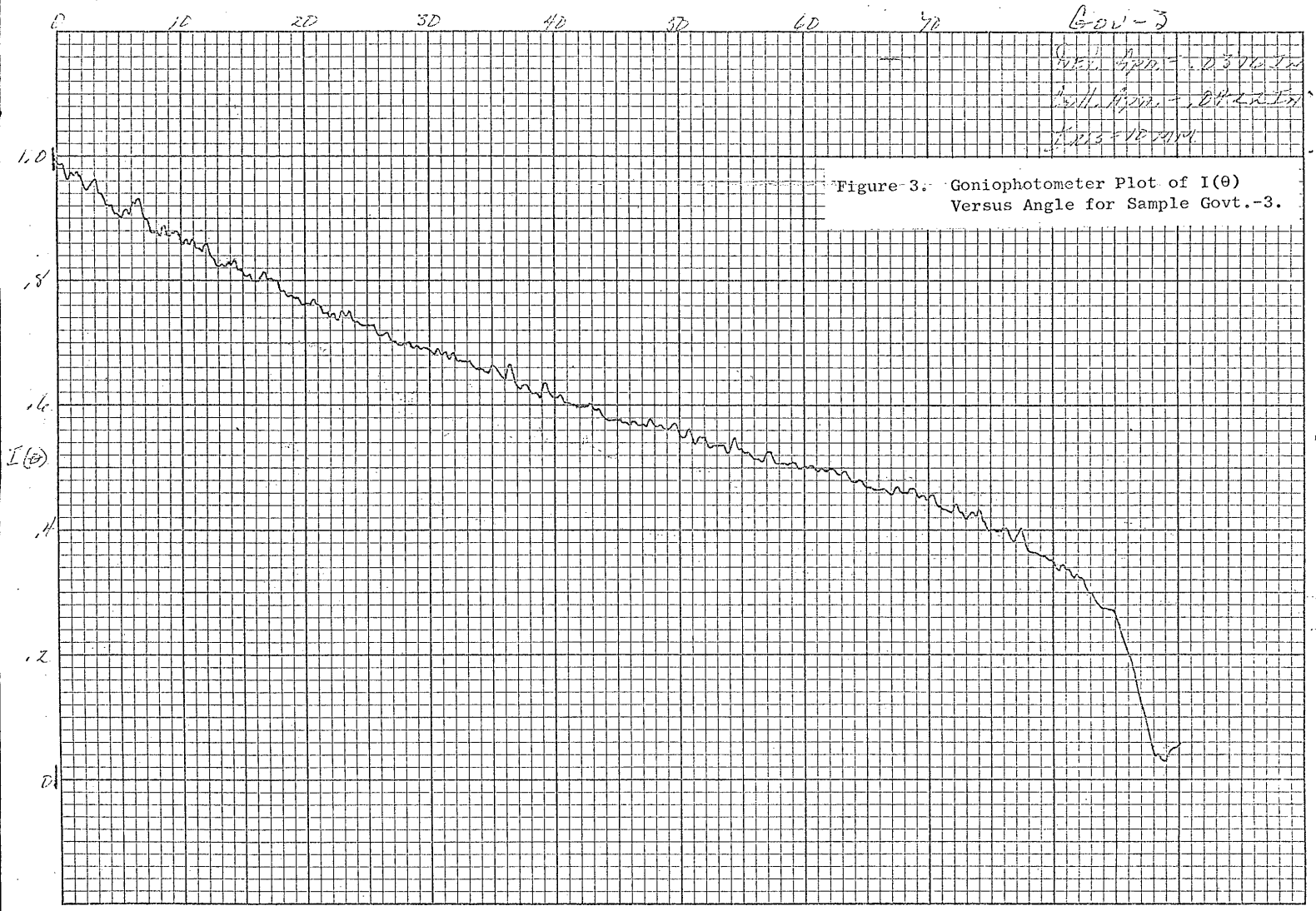


Figure 3. Goniophotometer Plot of I(θ) Versus Angle for Sample Govt.-3.



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Table 1

Sample Codes

| θ | Govt.-1 I(θ) | Govt.-2 I(θ) | Govt.-3 I(θ) |
|---|---|---|---|
| 0 | 1.40 | 1.00 | 1.00 |
| 5 | .385 | .895 | .925 |
| 10 | .22 | .805 | .87 |
| 15 | .181 | .745 | .815 |
| 20 | .15 | .705 | .765 |
| 25 | .133 | .661 | .727 |
| 30 | .115 | .62 | .687 |
| 35 | .102 | .58 | .65 |
| 40 | .094 | .53 | .615 |
| 45 | .085 | .50 | .577 |
| 50 | .080 | .45 | .56 |
| 55 | .075 | .41 | .53 |
| 60 | .070 | .372 | .50 |
| 65 | .062 | .343 | .47 |
| 70 | .058 | .308 | .455 |
| 75 | .049 | .26 | .405 |
| 80 | .015 | .193 | .35 |
| 85 | .005 | .03 | .26 |
| 90 | .000 | .000 | .000 |

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Table 2

ANGULAR GAIN FUNCTION FOR SAMPLE GOV.-1

FRACTION OF POWER INSIDE 90 DEGREES = .938

FRACTION OF POWER INSIDE 45 DEGREES = .492

SPECULAR TRANSMITTANCE = .000

FRACTION ABSORBED =

| ANGLE K | I(K) | GAIN(K) |
|---|---|---|
| 0 | 1.400 | 36.535 |
| 5 | .385 | 10.047 |
| 10 | .220 | 5.741 |
| 15 | .181 | 4.723 |
| 20 | .150 | 3.914 |
| 25 | .133 | 3.470 |
| 30 | .115 | 3.001 |
| 35 | .102 | 2.661 |
| 40 | .094 | 2.453 |
| 45 | .085 | 2.218 |
| 50 | .080 | 2.087 |
| 55 | .075 | 1.957 |
| 60 | .070 | 1.826 |
| 65 | .062 | 1.617 |
| 70 | .058 | 1.513 |
| 75 | .049 | 1.278 |
| 80 | .015 | .391 |
| 85 | .005 | .130 |
| 90 | .000 | .000 |

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Table 3

ANGULAR GAIN FUNCTION FOR SAMPLE GOV.-2

FRACTION OF POWER INSIDE 90 DEGREES = .944

FRACTION OF POWER INSIDE 45 DEGREES = .454

SPECULAR TRANSMITTANCE = .000

FRACTION ABSORBED =

| ANGLE K | I(K) | GAIN(K) |
|---|---|---|
| 0 | 1.000 | 4.982 |
| 5 | .895 | 4.459 |
| 10 | .805 | 4.010 |
| 15 | .745 | 3.712 |
| 20 | .705 | 3.512 |
| 25 | .661 | 3.293 |
| 30 | .620 | 3.089 |
| 35 | .580 | 2.889 |
| 40 | .530 | 2.640 |
| 45 | .500 | 2.491 |
| 50 | .450 | 2.242 |
| 55 | .410 | 2.042 |
| 60 | .372 | 1.853 |
| 65 | .343 | 1.709 |
| 70 | .308 | 1.534 |
| 75 | .260 | 1.295 |
| 80 | .193 | .961 |
| 85 | .030 | .149 |
| 90 | .000 | .000 |

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Table 4

ANGULAR GAIN FUNCTION FOR SAMPLE GOV.-3

FRACTION OF POWER INSIDE 90 DEGREES = .813

FRACTION OF POWER INSIDE 45 DEGREES = .333

SPECULAR TRANSMITTANCE = .000

FRACTION ABSORBED =

| ANGLE K | I(K) | GAIN(K) |
|---|---|---|
| 0 | 1.000 | 3.282 |
| 5 | .925 | 3.036 |
| 10 | .870 | 2.856 |
| 15 | .815 | 2.675 |
| 20 | .765 | 2.511 |
| 25 | .727 | 2.386 |
| 30 | .687 | 2.255 |
| 35 | .650 | 2.133 |
| 40 | .615 | 2.018 |
| 45 | .577 | 1.894 |
| 50 | .560 | 1.838 |
| 55 | .530 | 1.739 |
| 60 | .500 | 1.641 |
| 65 | .470 | 1.542 |
| 70 | .455 | 1.493 |
| 75 | .405 | 1.329 |
| 80 | .350 | 1.149 |
| 85 | .260 | .853 |
| 90 | .000 | .000 |

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Table 5

## SUMMARY OF ANGULAR GAIN FUNCTIONS

| ANGLE K | GOV.-1 | GOV.-2 | GOV.-3 | SAMPLE CODES | | |
|---|---|---|---|---|---|---|
| 0 | 36.535 | 4.982 | 3.282 | .000 | .000 | .000 |
| 5 | 10.047 | 4.459 | 3.036 | .000 | .000 | .000 |
| 10 | 5.741 | 4.010 | 2.856 | .000 | .000 | .000 |
| 15 | 4.723 | 3.712 | 2.675 | .000 | .000 | .000 |
| 20 | 3.914 | 3.512 | 2.511 | .000 | .000 | .000 |
| 25 | 3.470 | 3.293 | 2.386 | .000 | .000 | .000 |
| 30 | 3.001 | 3.089 | 2.255 | .000 | .000 | .000 |
| 35 | 2.661 | 2.889 | 2.133 | .000 | .000 | .000 |
| 40 | 2.453 | 2.640 | 2.018 | .000 | .000 | .000 |
| 45 | 2.218 | 2.491 | 1.894 | .000 | .000 | .000 |
| 50 | 2.087 | 2.242 | 1.858 | .000 | .000 | .000 |
| 55 | 1.957 | 2.042 | 1.739 | .000 | .000 | .000 |
| 60 | 1.826 | 1.853 | 1.641 | .000 | .000 | .000 |
| 65 | 1.617 | 1.709 | 1.542 | .000 | .000 | .000 |
| 70 | 1.513 | 1.534 | 1.493 | .000 | .000 | .000 |
| 75 | 1.278 | 1.295 | 1.329 | .000 | .000 | .000 |
| 80 | .391 | .961 | 1.149 | .000 | .000 | .000 |
| 85 | .130 | .149 | .853 | .000 | .000 | .000 |
| 90 | .000 | .000 | .000 | .000 | .000 | .000 |
| TS | .938 | .944 | .813 | .000 | .000 | .000 |
| T45 | .492 | .454 | .333 | .000 | .000 | .000 |
| TSP | .000 | .000 | .000 | | | |
| V45 | .885 | .333 | .268 | .000 | .000 | .000 |
| ADS | | | | | | |

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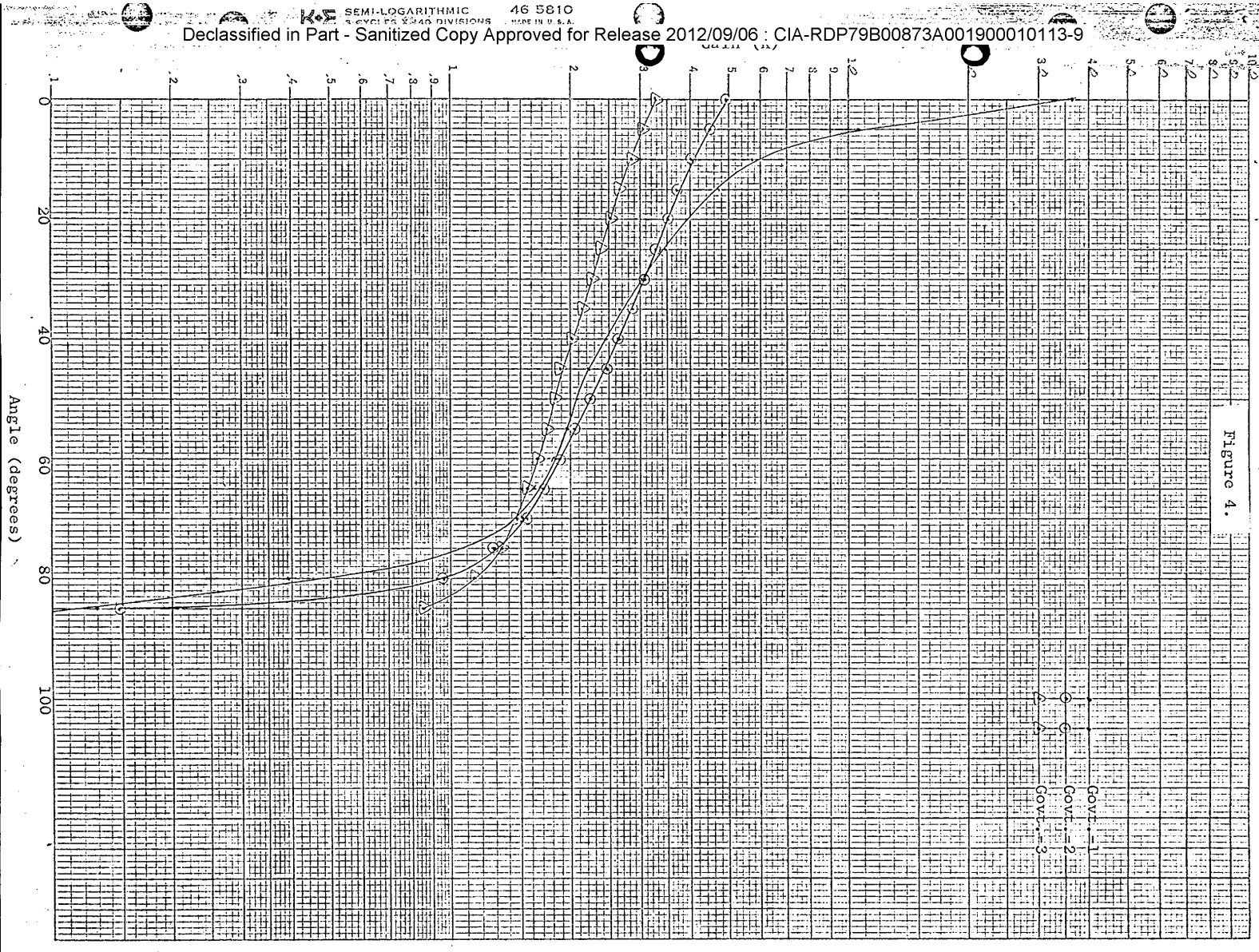


Figure 4.



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Figure 5. The Fraction of Incident Power Scattered Into $\pm 45^{\circ}$ as a Function of Axial Gain.

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Table 6

Summary of the Optical Properties of Fotoform$^{R}$ Glass

| Sample Code | $T_s$ % | $T_{45}$ % | $T_{spec}$ % | Axial Gain | Brightness Variation $\pm 45^{o}$ (%) | Crystal Thickness (mm) |
|---|---|---|---|---|---|---|
| Govt.-1 | 93.8 | 49.2 | 0.0 | 36.5 | 88.5 | $5.74 \times 10^{-2}$ |
| Govt.-2 | 94.4 | 45.4 | 0.0 | 5.0 | 33.3 | $1.635 \times 10^{-1}$ |
| Govt.-3 | 81.3 | 33.3 | 0.0 | 3.3 | 26.8 | $2.171 \times 10^{-1}$ |

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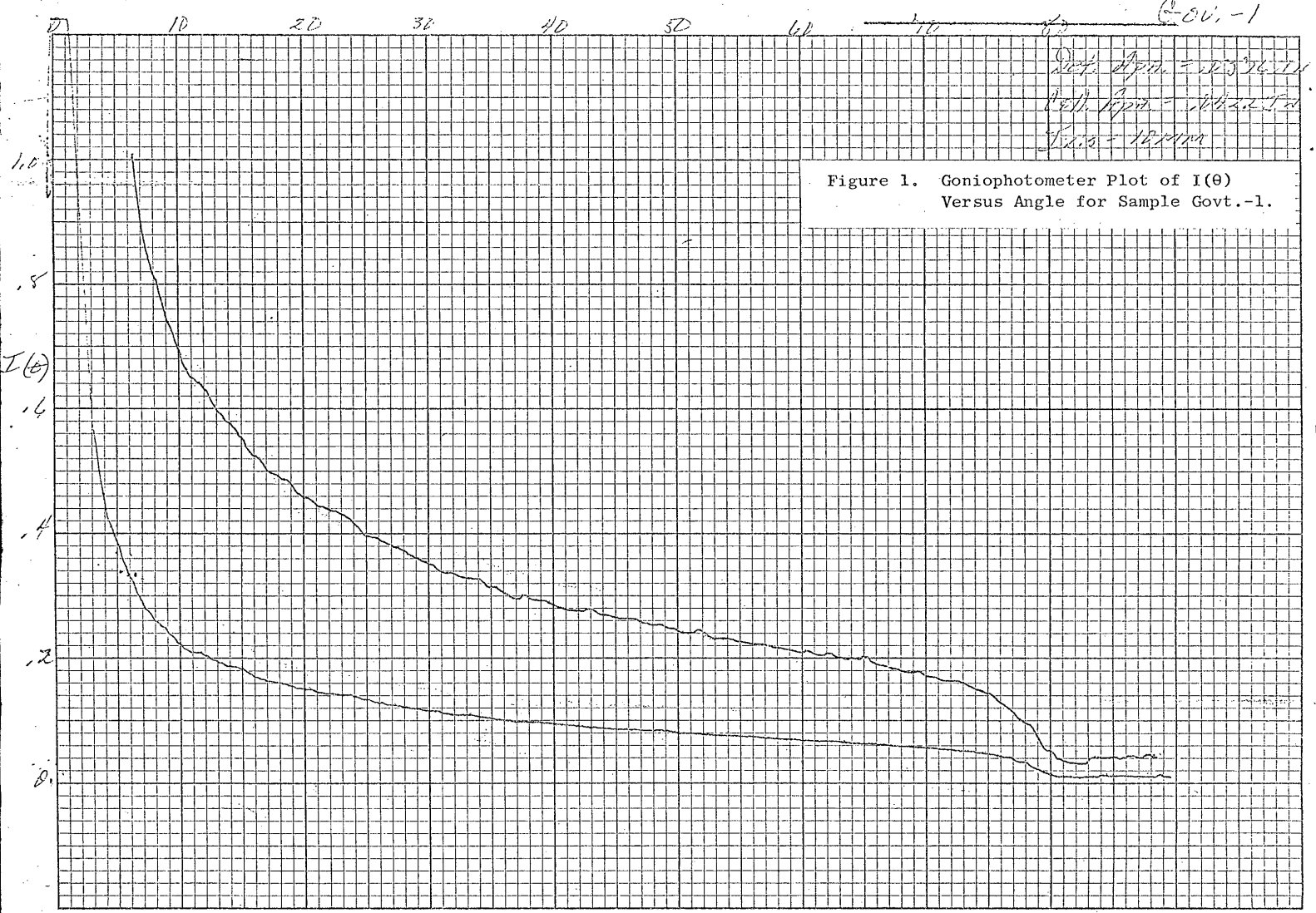


Figure 1. Goniophotometer Plot of I(θ) Versus Angle for Sample Govt.-1.



Angle θ

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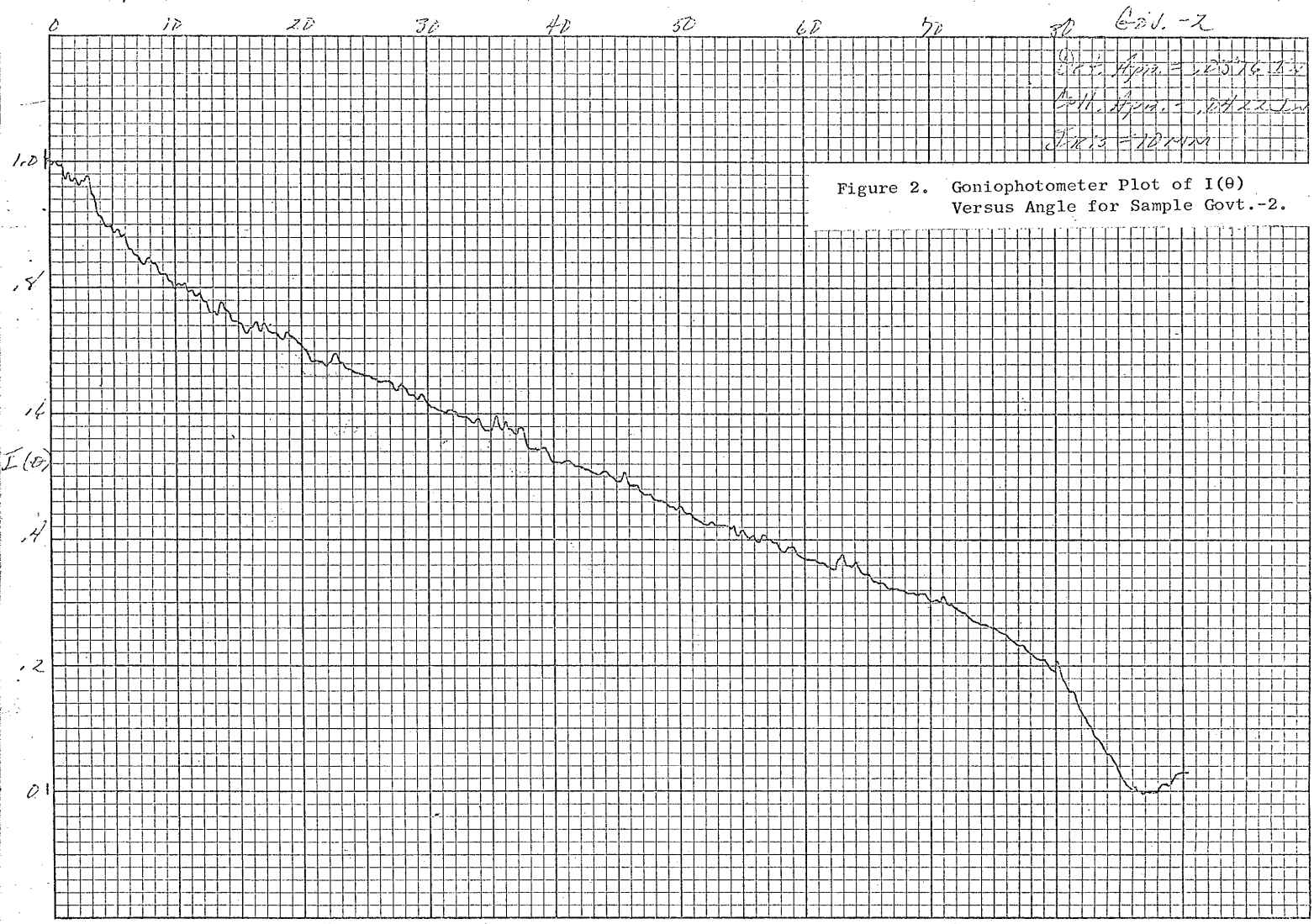


Figure 2. Goniophotometer Plot of I(θ) Versus Angle for Sample Govt.-2.



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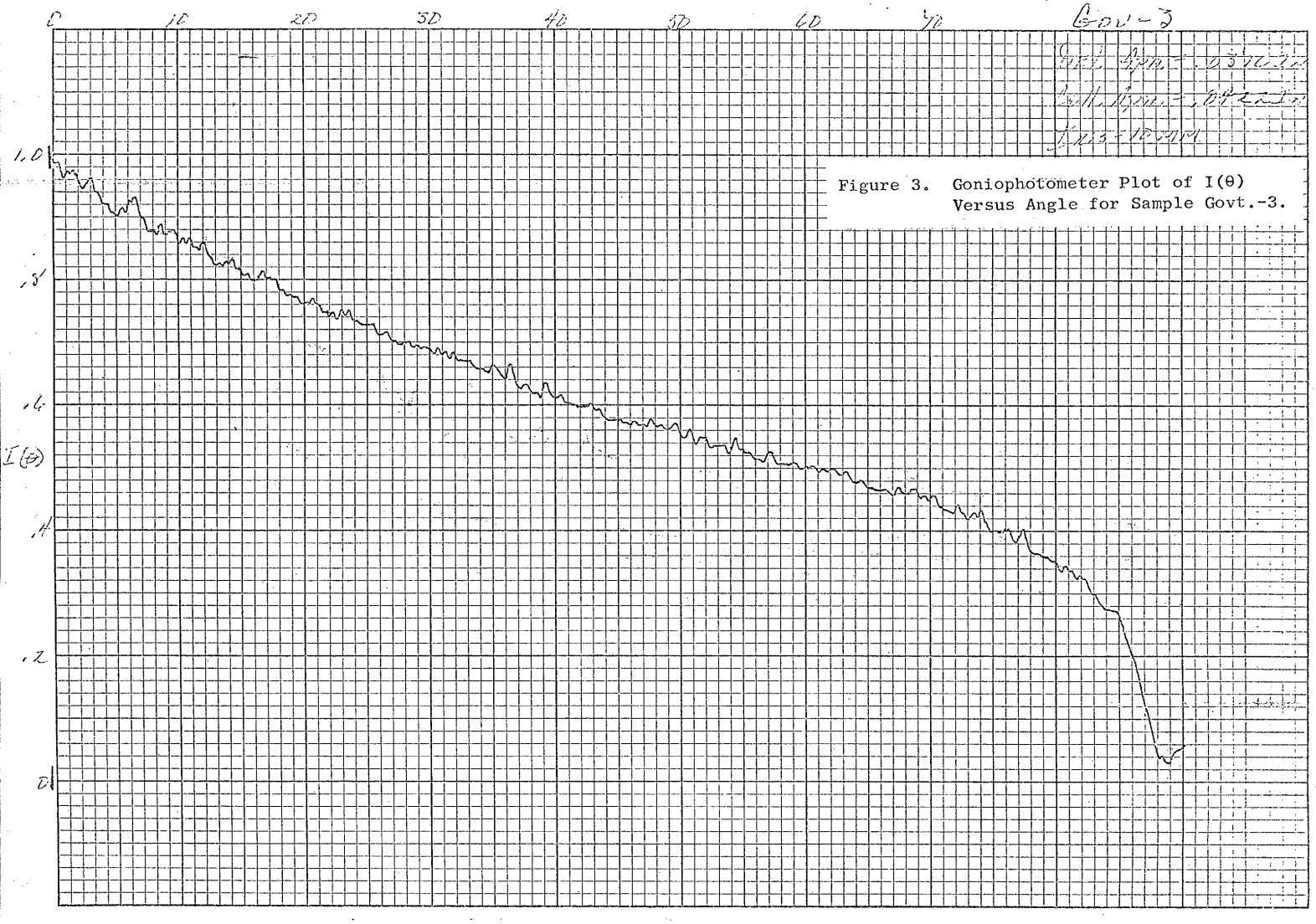


Figure 3. Goniophotometer Plot of I(θ) Versus Angle for Sample Govt.-3.



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Table 1

Sample Codes

| θ | Govt.-1 I(θ) | Govt.-2 I(θ) | Govt.-3 I(θ) |
|---|---|---|---|
| 0 | 1.40 | 1.00 | 1.00 |
| 5 | .385 | .895 | .925 |
| 10 | .22 | .805 | .87 |
| 15 | .181 | .745 | .815 |
| 20 | .15 | .705 | .765 |
| 25 | .133 | .661 | .727 |
| 30 | .115 | .62 | .687 |
| 35 | .102 | .58 | .65 |
| 40 | .094 | .53 | .615 |
| 45 | .085 | .50 | .577 |
| 50 | .080 | .45 | .56 |
| 55 | .075 | .41 | .53 |
| 60 | .070 | .372 | .50 |
| 65 | .062 | .343 | .47 |
| 70 | .058 | .308 | .455 |
| 75 | .049 | .26 | .405 |
| 80 | .015 | .193 | .35 |
| 85 | .005 | .03 | .26 |
| 90 | .000 | .000 | .000 |

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Table 2

ANGULAR GAIN FUNCTION FOR SAMPLE GOV.-1

FRACTION OF POWER INSIDE 90 DEGREES = .938

FRACTION OF POWER INSIDE 45 DEGREES = .492

SPECULAR TRANSMITTANCE = .000

FRACTION ABSORBED =

| ANGLE K | I(K) | GAIN(K) |
|---|---|---|
| 0 | 1.400 | 36.535 |
| 5 | .385 | 10.047 |
| 10 | .220 | 5.741 |
| 15 | .181 | 4.723 |
| 20 | .150 | 3.914 |
| 25 | .133 | 3.470 |
| 30 | .115 | 3.001 |
| 35 | .102 | 2.661 |
| 40 | .094 | 2.453 |
| 45 | .085 | 2.218 |
| 50 | .080 | 2.087 |
| 55 | .075 | 1.957 |
| 60 | .070 | 1.826 |
| 65 | .062 | 1.617 |
| 70 | .058 | 1.513 |
| 75 | .049 | 1.278 |
| 80 | .015 | .391 |
| 85 | .005 | .130 |
| 90 | .000 | .000 |

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Table 3

ANGULAR GAIN FUNCTION FOR SAMPLE GOV.-2

FRACTION OF POWER INSIDE 90 DEGREES = .944

FRACTION OF POWER INSIDE 45 DEGREES = .454

SPECULAR TRANSMITTANCE = .000

FRACTION ABSORBED =

| ANGLE K | I(K) | GAIN(K) |
|---|---|---|
| 0 | 1.000 | 4.982 |
| 5 | .895 | 4.459 |
| 10 | .805 | 4.010 |
| 15 | .745 | 3.712 |
| 20 | .705 | 3.512 |
| 25 | .661 | 3.293 |
| 30 | .620 | 3.089 |
| 35 | .580 | 2.889 |
| 40 | .530 | 2.640 |
| 45 | .500 | 2.491 |
| 50 | .450 | 2.242 |
| 55 | .410 | 2.042 |
| 60 | .372 | 1.853 |
| 65 | .343 | 1.709 |
| 70 | .308 | 1.534 |
| 75 | .260 | 1.295 |
| 80 | .193 | .961 |
| 85 | .030 | .149 |
| 90 | .000 | .000 |

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Table 4

ANGULAR GAIN FUNCTION FOR SAMPLE GOV.-3

FRACTION OF POWER INSIDE 90 DEGREES = .813

FRACTION OF POWER INSIDE 45 DEGREES = .333

SPECULAR TRANSMITTANCE = .000

FRACTION ABSORBED =

| ANGLE K | I(K) | GAIN(K) |
|---|---|---|
| 0 | 1.000 | 3.282 |
| 5 | .925 | 3.036 |
| 10 | .870 | 2.856 |
| 15 | .815 | 2.675 |
| 20 | .765 | 2.511 |
| 25 | .727 | 2.386 |
| 30 | .687 | 2.255 |
| 35 | .650 | 2.133 |
| 40 | .615 | 2.018 |
| 45 | .577 | 1.894 |
| 50 | .560 | 1.838 |
| 55 | .530 | 1.739 |
| 60 | .500 | 1.641 |
| 65 | .470 | 1.542 |
| 70 | .455 | 1.493 |
| 75 | .405 | 1.329 |
| 80 | .350 | 1.149 |
| 85 | .260 | .853 |
| 90 | .000 | .000 |

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Table 5

SUMMARY OF ANGULAR GAIN FUNCTIONS

| ANGLE | | | SAMPLE CODES | | | |
|---|---|---|---|---|---|---|
| K | GOV.-1 | GOV.-2 | GOV.-3 | | | |
| 0 | 36.535 | 4.982 | 3.282 | .000 | .000 | .000 |
| 5 | 10.047 | 4.459 | 3.036 | .000 | .000 | .000 |
| 10 | 5.741 | 4.010 | 2.856 | .000 | .000 | .000 |
| 15 | 4.723 | 3.712 | 2.675 | .000 | .000 | .000 |
| 20 | 3.914 | 3.512 | 2.511 | .000 | .000 | .000 |
| 25 | 3.470 | 3.293 | 2.386 | .000 | .000 | .000 |
| 30 | 3.001 | 3.089 | 2.255 | .000 | .000 | .000 |
| 35 | 2.661 | 2.889 | 2.133 | .000 | .000 | .000 |
| 40 | 2.453 | 2.640 | 2.018 | .000 | .000 | .000 |
| 45 | 2.218 | 2.491 | 1.894 | .000 | .000 | .000 |
| 50 | 2.087 | 2.242 | 1.838 | .000 | .000 | .000 |
| 55 | 1.957 | 2.042 | 1.739 | .000 | .000 | .000 |
| 60 | 1.826 | 1.853 | 1.641 | .000 | .000 | .000 |
| 65 | 1.617 | 1.709 | 1.542 | .000 | .000 | .000 |
| 70 | 1.513 | 1.534 | 1.493 | .000 | .000 | .000 |
| 75 | 1.278 | 1.295 | 1.329 | .000 | .000 | .000 |
| 80 | .391 | .961 | 1.149 | .000 | .000 | .000 |
| 85 | .130 | .149 | .853 | .000 | .000 | .000 |
| 90 | .000 | .000 | .000 | .000 | .000 | .000 |
| TS | .938 | .944 | .813 | .000 | .000 | .000 |
| T45 | .492 | .454 | .333 | .000 | .000 | .000 |
| TSP | .000 | .000 | .000 | | | |
| V45 | .885 | .333 | .268 | .000 | .000 | .000 |
| ABS | | | | | | |

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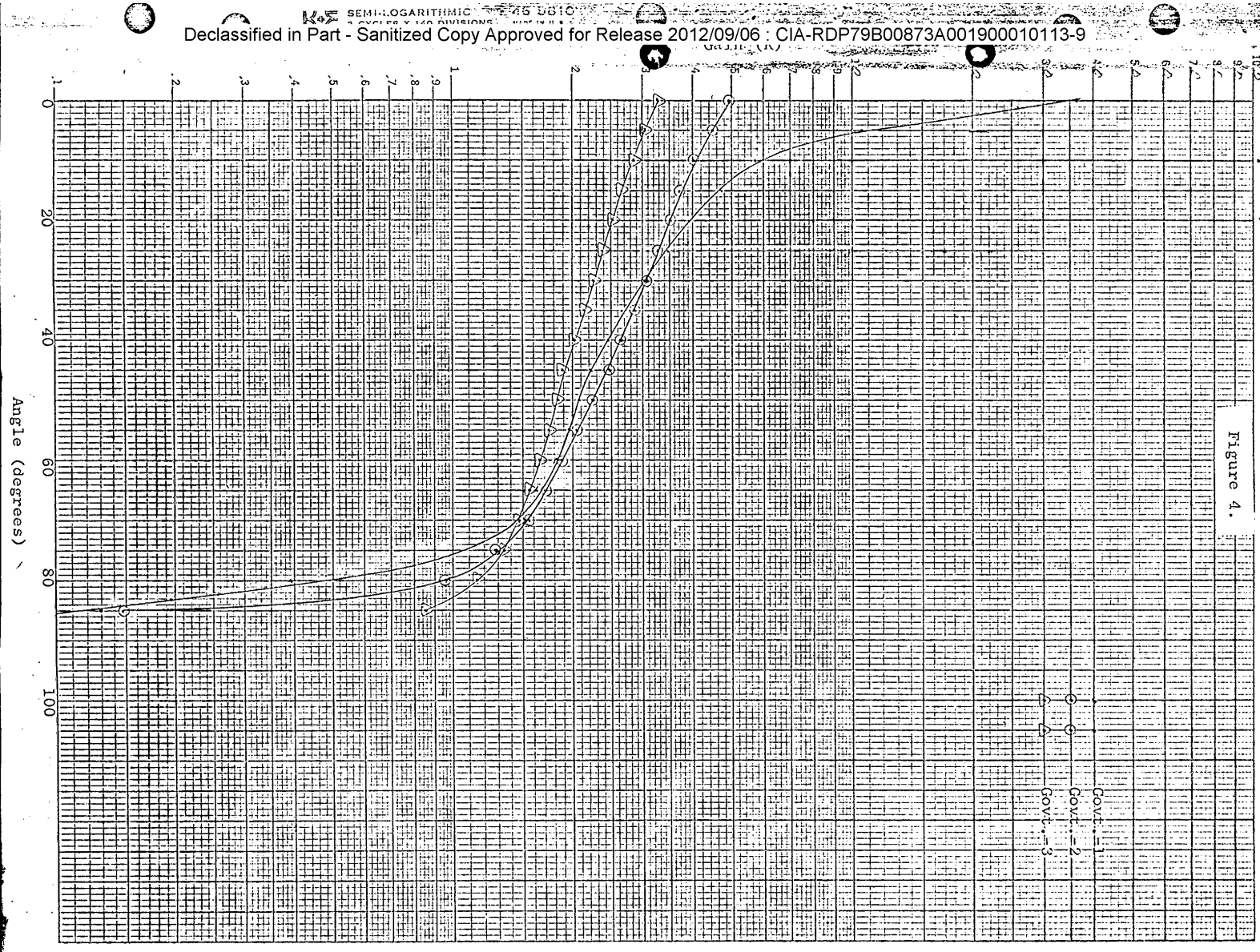


Figure 4.



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Figure 5. The Fraction of Incident Power Scattered Into $\pm 45^{\circ}$ as a Function of Axial Gain.



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Table 6

Summary of the Optical Properties of Fotoform$^{R}$ Glass

| Sample Code | $T_s$ % | $T_{45}$ % | $T_{spec}$ % | Axial Gain | Brightness Variation $\pm 45^{o}$ (%) | Crystal Thickness (mm) |
|---|---|---|---|---|---|---|
| Govt.-1 | 93.8 | 49.2 | 0.0 | 36.5 | 88.5 | $5.74 \times 10^{-2}$ |
| Govt.-2 | 94.4 | 45.4 | 0.0 | 5.0 | 33.3 | $1.635 \times 10^{-1}$ |
| Govt.-3 | 81.3 | 33.3 | 0.0 | 3.3 | 26.8 | $2.171 \times 10^{-1}$ |

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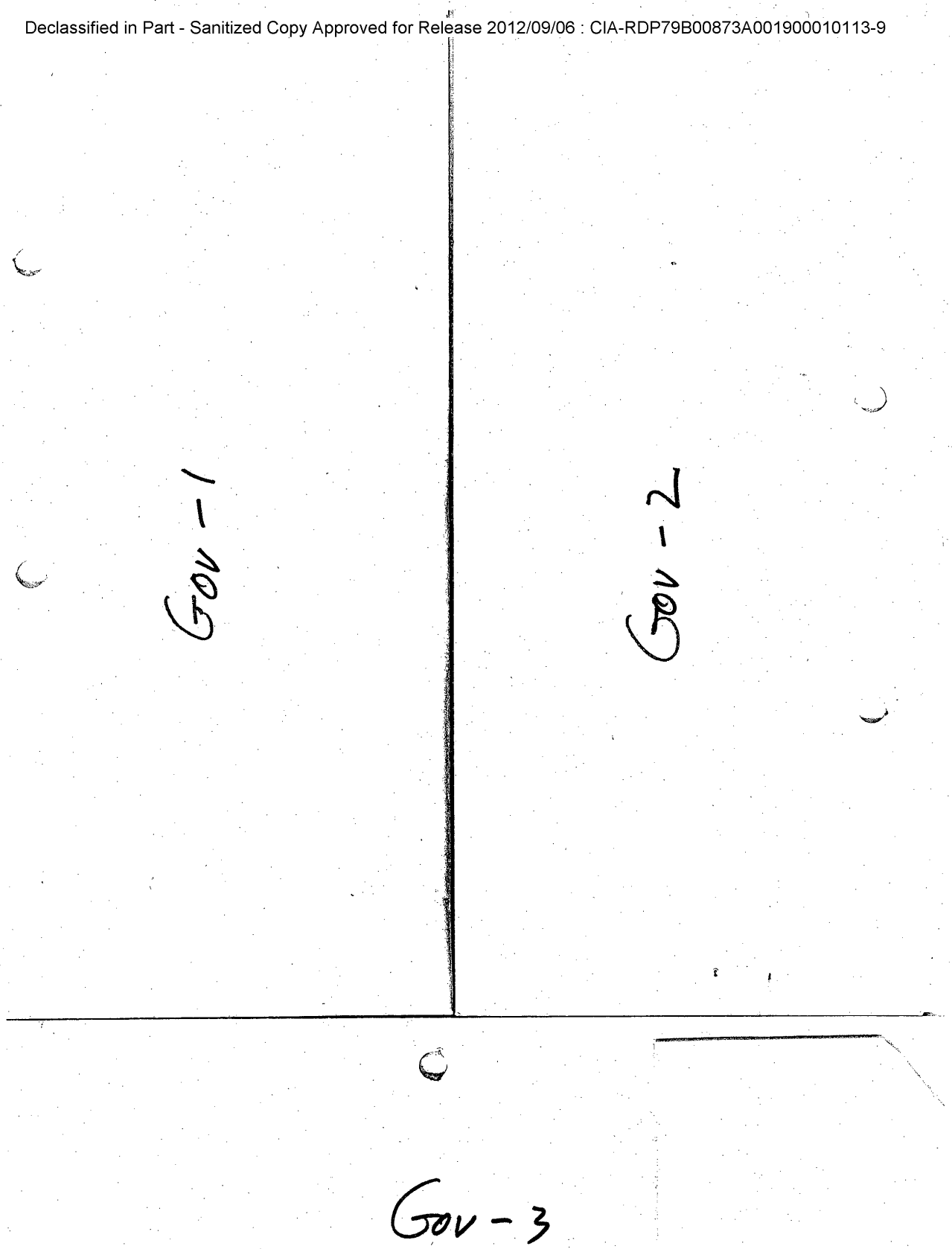


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